Vertical Coordination Design between Farmers and Marketing Cooperative in China: Famers' Participation in a Cooperative

AUTHOR(S):

ASAMI, Atsuyuki

CITATION:

ASAMI, Atsuyuki. Vertical Coordination Design between Farmers and Marketing Cooperative in China: Famers' Participation in a Cooperative. 生物資源経済研究 2019, 24: 1-18

ISSUE DATE:

2019-03-25

URL:

http://hdl.handle.net/2433/240905

Vertical Coordination Design between Farmers and Marketing Cooperative in China: Famers' Participation in a Cooperative

Atsuyuki ASAMI

Kyoto University

浅見淳之：中国における組合員農家と販売協同組合の間の垂直的調整デザイン
―協同組合への農家の参加はいかに決まるのか―

中国の農村発展のために、販売協同組合（マーケティング農民専業合作社）の普及が強く求められている。そのためには、いかなる要因が、農民の協同組合への参加を促進するのかを明らかにしなければならない。本論文では第一に、取引費用、所有権、ケイパビリティという視点での組織の経済学のアプローチによって、組合員と協同組合の間の垂直的調整のデザインとして、参加の要因を明らかにした。第二に、湖南省での調査データを用いることによって、その垂直的調整のデザインを検証した。分析の結果、農民と協同組合の間の関係特殊性と協同組合のもつケイパビリティが参加を促進するが、一方で、農産物価格の値下げ要求が予想され、また調整のための取引費用が発生すると参加は抑制されてしまうことがわかった。

1. Introduction

As is well known, Chinese agricultural production was increased drastically by a rural institutional reform such as an introduction of family contract responsibility system. Nowadays, foundation of "Farmers professional cooperatives" (hereafter, this is abbreviated to "FPC") is paid the most attention as the institutional reform. The weakness of small size farmers can be reinforced by autonomous organization of farmers that drives collective power. Typical organization of this type is the agricultural cooperatives, and FPC is one of these cooperatives. Especially, enactment of cooperative law in 2007 caused drastic increase of FPC in rural area, and FPC is expected to play a main role for rural development (See Jia et al. (2012), World Bank (2006)).

Corresponding to this expectation, its significance and problems were pointed out from the conventional economics viewpoints such as its efficiency (Huang et al. (2013)) and agricultural policy (Deng et al. (2010)). Although these viewpoints are important, the key issue in practice is acceleration of farmers' participation in FPC or more foundation of FPC. The income gain that farmers can obtain after participation is an important factor for participation (Ito et al. (2012)). However, this viewpoint can be applied not only to FPC but also to any kinds of organization. The viewpoint peculiarly related to FPC must be clarified for practical

purpose.

We consider the peculiarity is found in the fact that FPC have been formed in food system, corresponding to “agriculture industrialization policy.” [1)] These FPC play roles as marketing cooperatives in food system. These are concretely explained as follows. A food processing company or a distributing company organizes FPC with farmers and become “a processing or marketing unit of the FPC” (hereafter, this is abbreviated to “PMUC”). PMUC purchases agricultural products from member farmers, and it processes the products and sells them to consumers. We focus on farmers’ participation in this type of marketing cooperative.

How can we grasp farmers’ participation in the context of food system? Food system is defined as nexus of transaction between supplier and buyer. Accordingly, we must pay attention to a vertical coordination between both parties in food system (See Frank and Henderson (1992), Royer and Rogers (1998), Galizzi and Venturini (1999)). The vertical coordination of food system can be well analyzed by applying “Organizational Economics” which studies relationship between supplier and buyer based on transaction cost, property rights, or incomplete contract theory (See Cook and Barry (2004), Menard and Klein (2004)). Especially, an organization of the cooperative that control food system has been mainly analyzed in conventional research of this field (Sykuta and Cook (2001)). A cooperative is considered as organization of vertical coordination between supplier (farmers) and buyer (PMUC), consequently the cooperative has been studied based on organizational economics (See Hendriske and Veerman (2001a,b), Hendriske and Bijman (2002), Cook et al. (2004)).

Some studies also analyzed FPC as the organization of vertical coordination, such as studies on a contractual arrangement (Jia and Huang (2011)), cooperatives in supply chain (Jia et al. (2012)), governance structure(Jia et al. (2016)). However, very little attention was given to practical issues of farmers’ participation in a cooperative in previous studies. No research has yet been carried out to analyze a design of participation based on organizational economics. Thereupon in this paper, first, we present the design of participation in marketing FPC as vertical coordination, and second, we test quantitively the design by using data that was collected in Hunan Province of China.

2. Conventional approach of organizational economics

2-1 Organizational economics and cooperatives

First, we explain how vertical coordination is dealt with in organizational economics. This economics focuses on working out a design of firm organization at the viewpoint of whether

the firm sources out components or produce them in-house. Outsourcing stands for procurement through market, and production in-house stands for operation in vertical integration. The design of firm organization is described as what extent of operations should be integrated vertically. The purpose of the study is to investigate the design of the most efficient extent of vertical integration between supplier and buyer of components. Accordingly, the design is described as the efficient allocation between integration procurement and market procurement, which we call as "vertical coordination design."

Participation in FPC is defined as follows in accordance with vertical coordination design. Participation means that a farmer invests a contribution money to the cooperative and takes part in decision making of processing and marketing of agricultural products. Member farmers, directors of company, and concerned village cadres debate heatedly the concerned activities involving product's contract price at the meeting. The situation that the company become PMUC of FPC designates that the farmer integrates downstream the company. The farmers commission PMUC to process and sell agricultural products using its ability.

The vertical coordination design of FPC is defined as the allocation of what extent each farmer integrates company, namely sells the products through PMUC of FPC, and what extent each farmer sells to the market directly. Selling through FPC stands for farmers' participation in the cooperative. Farmers' participation is defined as each farmer's vertical integration of company that is measured by the rate of farmer's sale through FPC.

2-2　Transaction cost and property right approach

An agricultural cooperative organization has been discussed using two approaches of organizational economics: transaction cost approach and property right approach.[2)] The former approach focuses on a cost that occurs on transaction process. This investigates the vertical coordination design from the viewpoint of choosing the most cost saving transaction mode between market and vertical integration. Williamson (1979) explains the design by using "relationship specificity"[3)] : the condition where the identity of supplier and buyer matters for their continuity of relationship and they can't easily switch each partner. The extent of specificity decides transaction mode, because the degree of proportionality relating the specificity to its transaction cost is different in the respective mode.

The property right approach is developed by Grossman and Hart (1986) and Hart (1995). In the case that the transaction is specified to the buyer, the buyer is apt to make a demand for price cut, using the situation that the supplier can't switch the buyer easily when the price is renegotiated after a contract. Thus, the supplier predicts buyer to compel him to cut the price, which reduces his incentive to invest. This compulsion is called as "hold-up."

The supplier tries to acquire the property right of buyer, namely integrate the buyer to resolve this problem.

Above mentioned two approaches are applied to analysis of an agricultural cooperative organization. Compared with a traditional firm, Hendriske and Veerman(2001b) indicates its inefficiency using the transaction cost approach. Using the property right approach, Hendriske and Bijman (2002) shows that a cooperative has a desirable structure of property right for investment. Hendriske and Veerman(2001a) suggests that a cooperative can solve the hold-up problem but high relationship specificity is not a desirable structure. However, these studies treat the agricultural cooperative like a general firm and do not consider peculiarity of a cooperative. In addition, there is no empirical study. Taking account of the peculiarity, we will examine what factors decide farmers' participation in the form of vertical coordination design.

As for transaction cost approach, we focus on the relationship specificity which can be measured by the extent that the parties can't switch the partner without any loss of value. If the identity of ex-ante invested physical or human asset, the production site, or a brand name are specified to transaction partner, then bilateral dependency develops more between parties, and the extent of relationship specificity is intensified.

According to Williamson (1979), supplier or buyer is unable to respond easily to partner's hold-up behavior in the high relationship specificity under the market transaction, and incurs high transaction cost. If transaction mode transfers from market to vertical integration, the transaction cost will decrease. Instead, an internal bureaucratic cost will increase, but the created value is more than offset of increase and decrease of cost. Accordingly, the vertical integration mode is selected in the case of high specificity. However, if it is the case of the market mode where the relationship specificity is very low and the bureaucratic cost is not needed, the transaction cost can be saved, because of parties' quick response. Then, the market transaction mode is selected in the low specificity. This theory, thus, indicates that the higher relationship specificity accelerates formation of vertical integration.

As for FPC, the higher relationship specificity accelerates farmer's vertical integration of company, that is, encourage farmers' participation in a cooperative. Identity of technology, brand name, production standard, or perishability are specified to partner in the case of agricultural product trade. Thus, we build up a hypothesis related to transaction cost as follows.

Hypothesis 1: The higher relationship specificity results in the higher extent of farmers' participation in a cooperative.

Property right approach focuses on hold-up problem. The more critical hold-up problem accelerates an extent of vertical integration under a given relationship specificity. Ex-post price is also renegotiated in contract agriculture where a contract is signed before seeding, and actual transaction is executed after harvesting. Thus, these transactions also suffered from hold-up problem. In the case of industrial firms, the buyer can hold up the supplier using his position of bilateral oligopoly where the supplier can't switch the partner easily. However, in the case of contract agriculture where many farmers deal with one company, it cannot be considered that the company holds up many farmers one by one.

Taking account of these situations, we divide hold-up problem of contract agriculture into two parts. (1) The company could compel a farmer to cut the price due to the difficulty of switching partner. When the farmer predicts this hold-up, he reduces the incentive of investment, because he is anxious about wasting sunk cost of already invested resource. (2) However in reality, the company will not compel farmers to cut the price one by one, because it is extraordinarily time consuming.[4)] That is to say, a farmer can participate in the cooperative to ease the anxiety of the compulsion. But hold-up problem does not occur and does not accelerate participation, because of avoiding irksome negotiation one by one. Thus, we build up hypotheses related to hold-up problem as follows.

Hypothesis 2: Hold-up problem is not related to participation in a cooperative.

Hypothesis 3: If the compulsion of price cut is predicted, a farmer is anxious about waste of sunk cost and restrains participation in a cooperative.

3. Capability approach to analysis of cooperatives

3-1　What is capability approach?

We must focus on a capability approach of organizational economics that was not paid attention in cooperatives studies. Conventional approach focused on an aversion of negative phase such as saving transaction cost and avoiding hold-up problem. In contrast, practical business emphasizes a creation of positive phase that firm seeks to acquire other firms to exploit their superior capabilities. Vertical integration is conducted in the case that the superiority of capability can be exploited only through acquisition of partner. We need to focus on this positive phase of vertical integration.

Langlois and Robertson (1995) represents this approach. They indicate that the firm incurs

large transaction cost to obtain a superior capability of partner by vertical integration. Suppose a maker needs to utilize a superior marketing capability of a partner distributer, when he launches a novel product. However, the distributer is not familiar with this product at first. Accordingly, a coordination such as persuasion of learning the novelty is required to make the distributer take charge of marketing anew. If the learning content is tacit knowledge such as know-how, the coordination becomes more difficult, and more coordination cost incurs. The extent of vertical integration is decided by comparison of the capability benefit with this coordination cost.

Farmers' participation in a cooperative is defined as a farmer's vertical integration of the company to exploit its superior processing and marketing capability. Famer can enjoy the added value of superiority which he cannot obtain in the case of selling to other private processors or traders. However, he must make the company take an unexperienced charge of his own product at first, and then incurs coordination cost. We need to compare the superiority of the company as PMUC with the coordination cost.

3-2 Participation to obtain capability

A farmer participates in FPC to obtain its superior capability of the company that become PMUC. PMUC can produce a differentiate profit that other traders can't, because PMUC owned by the farmer himself can easily understand the merits of his product and his technology, and easily makes use of these merits.

The substance of these merits understood by PMUC is the tacit knowledge that can't be depicted verbally. When a farmer makes PMUC take unexperienced charge of his product, he incurs the coordination cost of persuading PMUC to understand these merits. In reality, farmers persuade the directors of companies enthusiastically and they debate about the deal heatedly at the general meeting and at every opportunity. The extent of participation decides during these debates, comparing the obtainable profit with the coordination cost. We explain this comparison using the Nash bargaining game between a farmer and PMUC, because Nash solution is always applied to analysis of vertical integration in organizational economics. We premise that there are no information asymmetries but a contract is incomplete.

Suppose a farmer is X and PMUC is Y, we explain the farmer's vertical integration, that is his participation in FPC, with referring to Figure 1. Suppose both player splits one unit of a benefit of integration. We use x, y to denote possible agreements of each, and the feasible set of agreements is demarcated by pareto-optimal frontier of $y=-ax+b$. As for processing and marketing, Y is more competent than X. Accordingly, we assume $b>0$ and $a>1$, which describe relative competences. The larger a is, the larger the capability of Y is.

The extent of participation can be measured by an outside option. The outside option is the payoff that is guaranteed even in the case of an unsuccessful transaction between X and Y. This guaranteed payoff can be obtained, when X switches the partner from Y to other second-best partner, and vice versa. The large outside option stands for the situation that large number of products are sold directly to the market, and small portion is sold through FPC. Famer can easily switch the buyer and realize large outside option, which means a lower level of participation. Decrease of outside option stands for increase of the difficulty of switching partner, and it shows a higher level of participation.

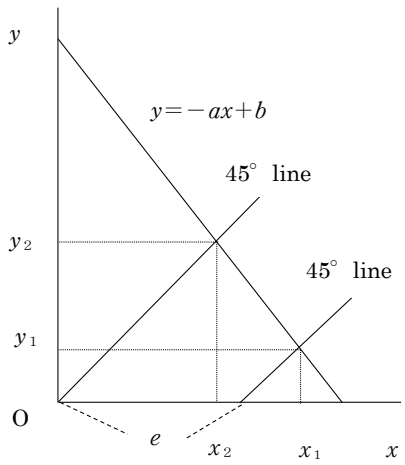

Figure 1　Nash bargaining game

Suppose the extent of outside option is e $(\geqq 0)$ in Figure 1, it displays a smallness of dependence of X on Y. Decrease of e, in which e (>0) is approaching to 0, shows increasing extent of participation. To simplify matters, we don't take Y's outside option to X into account.

We compare two cases. One is a certain size of outside option e of no participation. The other is the no outside option case of $e=0$ in which only PMUC is utilized, that is full-scale participation. According to Nash bargaining solution, payoff (x_1, y_1) of full-scale participation and (x_2, y_2) of no participation are agreed respectively. Comparing the sum of agreed payoff in each case, we can examine a profit of participation. $x_1=(b+ae)/2a$, $y_1=(b-ae)/2$ can be derived by $Max\ (x-e)(-ax+b)$. $x_2=b/2a$, $y_2=b/2$ can be derived by $Max\ (x)\ (-ax+b)$. The total payoff of full-scale participation is:

$$x_1+y_1=(ab-a^2e+b+ae)/2a. \qquad (1)$$

The total payoff of no participation is:

$x_2+y_2=(ab+b)/2a.$ （2）

Subtracting equation (1) from (2), we get $e(a-1)/2$. Its sign condition is positive, because of $a>1$. This means that the total payoff of X and Y increases by a farmer's participation. If Y is more competent than X, it is more profitable for both to use the capability of Y in the form of farmers' participation. The increase effect of the participation is $(a-1)/2$ under given e. The larger size of Y's competence a is, the larger the participation effect $(a-1)/2$ is. Accordingly, the larger a induces more e, namely the larger capability of PMUC induces the more extent of participation.

However, X must incur the coordination cost to obtain the profit from the capability of Y. Suppose this cost is C, $e \geq 2C/(a-1)$ is a participation constraint for a farmer. The smaller C and the larger a can easily satisfy this inequality, that is, the smaller coordination cost and the larger capability accelerates the participation.

3-3 Two aspects of capability

Above mentioned results indicate that the larger capability accelerates farmers' participation accompanying with larger coordination cost. This shows there are a positive and negative aspects of using capability. We explain these two aspects using Nash bargaining game.

When we investigate the capability in detail, we find that the capability consists of two knowledges: a general knowledge of processing and marketing and a specialized knowledge that can be performed after understanding the merits of the partner farmer. The former is called as "general knowledge" and the latter is called as "specialized knowledge." The specialized knowledge is the very thing that produces the differentiate profit. Suppose the capability that PMUC originally owns is p. p is directly utilized as the general knowledge. However, when the specialized knowledge is utilized, p must be adjusted for PMUC to understand his merits. The original capability p is processed into a specialized capability $K(p)$. PMUC utilizes $K(p)$ as the specialized knowledge in actuality.

When PMUC utilizes $K(p)$, the coordination is required beforehand. The farmer discusses his product with PMUC heatedly and tries to let PMUC understand his merits. This coordination has been conducted until the decision of participation. This means that the farmer has been coordinating in the dynamic process until PMUC starts to utilize $K(p)$. Accordingly, this process of coordination is described as a change of $K(p)$, namely $K'(p)$. We assume $K'(p)>0$, because the specialized capability $K(p)$ increases in proportion to the original capability p. $K'(p)$ and p are taken into consideration during their discussion before the farmer decides on participation.

We consider the region where Y is more competent than X in Figure 1, that is, the feasible set is demarcated by pareto-optimal frontier of $y=f(x)$ ($f'<0, f''<0$), which is more generally described rather than $y=-ax+b$. In addition, we focus on the region of $dy/dx<-1$ or $(x+f(x))'<0$, and $dy/dx \cdot x/y<-1$ or $(xf(x))'<0$. These stands for the situation that Y is more competent, and both sum and product of payoff increases by the farmer's participation that is described in a move from (x_1, y_1) to (x_2, y_2) in Figure 1.

The extent of farmers' participation is decided on the agreement that maximizes the total payoff of x and y. According to Nash bargaining solution, the total payoff is assumed to be Nash product, N. X and Y agree on maximization of a product of x and y, while considering the original capability p and the change of specialized capability $K'(p)$ in discussion. Accordingly, Nash product N is described as $N(x(p), y(p), K'(p), p)$ in this case.

The larger capability of Y accelerates the participation, which results in increase of the total payoff N. This means that the larger original capability p results in the larger total payoff N, that is, $Np>0$. As for the specialized capability $K(p)$, we can get $N_K>0$ in the same way. As for the coordination process, the greater change in the increase of specialized capability accelerates the participation and results in the larger N. The smaller change in its increase regresses the participation and results in the smaller N. Accordingly, we assume $N_{K'}>0$.

We assume x^*, y^* are the bargaining solution that maximize the Nash product N. Maximum value function where the choice variables have been assigned their optimal values x^*, y^* is $N(x^*, y^*, K'(p), p)$. The condition of p to maximize N is

$$-\frac{dK'}{dp}=Np/N_{K'}. \qquad (3)$$

We can get $\frac{dK'}{dp}<0$, because of $Np>0$, $N_{K'}>0$. This condition verifies the existence of the coordination cost. The larger specified capability requires the more additional activity such as persuading to utilize the capability. Although $K(p)$ is tried to increase as p grows, the degree of its increment must be diminishing due to the coordination cost. This causes negative effect on participation.

The results obtained show as follows. Participation is accelerated in proportion with both general and specialized capability because of $K'(p)>0$, $N_K>0$. However, the coordination cost refrains participation before utilization of the capability. Thus, we build up a hypothesis related to capability as follows.

Hypothesis 4: The larger capability of PMUC accelerates farmers' participation in a cooperative.

Hypothesis 5: However, the coordination cost is incurred for participating in the cooperative to use the capability.

4. Constructs and data

4-1 Variables

Now we propose the constructs of variables to test above mentioned 5 hypotheses that are formulated on organizational economics. We assume an explained variable, *participation*, as a value ratio of selling the product through FPC to agricultural sales amount per farmer. This represents the level of farmers' participation in a cooperative.

We develop the following 5 explanatory variables to explain *participation* in the framework of vertical coordination design. (1) *less-specificity*: It is the extent to which the farmer's trade is not specified to PMUC as partner. It is measured by the farmer's evaluation that a termination of transaction with PMUC doesn't cause any serious problems. This restrains participation in a cooperative. We test hypothesis 1 using this variable. (2) *hold-up*: It is the extent of hold-up problem. It is measured by the farmer's prediction that PMUC will compel the farmer to cut the contracted price or change conditions after harvesting. This is not related to participation. We test hypothesis 2 by this variable. (3) *sunkcost*: It is the extent to which the farmer is anxious about waste of sunk cost for already invested resource, when PMUC compel to cut price and the farmer cannot but switch the partner. If a predicted waste of sunk cost is so large, the farmer restrains participation. We test hypothesis 3 by this variable. (4) *capability*: It is the extent to which the farmer evaluates the large capability of PMUC. This accelerates participation. We test hypothesis 4 by this variable. (5) *understandability*: It is an easiness which the farmer has PMUC understand the merit of the farmer. More easiness can reduce the coordination cost. It is measured by the farmer's evaluation that he assesses perspicuity of his own merit. This is positively correlated to capability. We test hypothesis 5 by this variable.

In addition, we devise the following 4 control variables. (6) *power*: It is a degree of barging power in which PMUC recognizes the farmer's enough influence on decision of contract term. The bigger barging power accelerates participation. (7) *satisfaction*: It is the degree of how much the farmer is contended with PMUC as a trade partner. The more satisfaction accelerates the participation. (8) *relationship*: It is the extent to which human relationship is built between the farmer and PMUC. The deeper relationship accelerates participation. (9) *uncertainty*: It is an easiness which the farmer can forecast future market trend of the dealt

product. The farmer passively sales by himself in the lower uncertainty situation.

4-2 Measure and data collection

We developed the data of above mentioned variables employing a market research method based on Bagozzi(1994), because of the lack of statistical data. Market research analyzes quantitively the factors that organizational economics studies, such as transaction cost, relationship specificity, and vertical integration (See Klein et al. (1990), Majumdar and Ramaswamy (1995), and John and Weitz (1998)). We developed anew the measures related to FPC, referring to measures of these previous research.

Member farmers of marketing FPC in Hunan province are selected as the setting for empirical test. The reason of selection is that the number of FPC has increased drastically since 2007 in Hunan. First, we conducted pre-study interviews for 73 members of 7 marketing FPC near Changsha city in 2013. We developed 51 items as observed variables that explain 9 latent variables corresponding to above mentioned variables from hearing survey. We omitted the items that farmers can't understand correctly through pre-test interview, and finally adopt 27 items. Measures of items corresponding to each latent variable are shown in Table 1. As for power and understandability, we employed only one item that farmers can understand without any ambiguity. These items were measured using seven-point Likert scales ranging from "Strongly disagree" to "Strongly agree."

We conducted main-study interview for marketing FPC of vegetable, fruits, rice, and industrial crop in whole area of Hunan in 2015. We interviewed 567 members of 14 marketing FPC.

4-3 Validity and reliability

It is important to establish the validity of the constructs of variables. First, the items of latent variables are factor analyzed to investigate their factor structure. We test whether each latent variable is validly comprised of corresponding items as each explanatory variable, by examining whether items load significantly on at least one factor, that is more than 0.30. Maximum likelihood method and promax rotation are employed. The results are shown in Table 1. All items appropriately loaded on their respective latent variables with loadings above 0.40.

As for these valid variables, all of Cronbach's α that measure an internal consistency are above 0.7, which shows high reliability. All of correlation coefficients between first item and other items in respective variables are significantly above 0.40, and these show a convergent validity. Consequently, we confirm that the latent variables comprised of items can be used

Table1 Confirmatory Factor Analysis of Questionnaires

questions	loading [1]	correlation [2]	α
sunkcost			
1. If I switch the present partner to another, the specific effort for product quality improvement that I have already made specially for the present partner is wasted.	0.862		0.839
2. If I switch the present partner to another, the specific technological knowledge that I have already studied specially for the present partner is wasted.	0.770	0.650 ***	
3. If I switch the present partner to another, the specific investment that I have already spent specially for the present partner is wasted.	0.758	0.686 ***	
4. If I switch the present partner to another, the specific effort for marketing that I have already made specially for the present partner is wasted.	0.751	0.619 ***	
satisfaction			
1. I will continuously deal with the FPC from now on.	0.881		0.807
2. I'm satisfied with the FPC's work so far.	0.823	0.674 ***	
3. The FPC has gained a reputation for its high-quality marketing work.	0.584	0.579 ***	
4. If the FPC requires new variety, I will accede because I trust it so far.	0.501	0.479 ***	
less-specificity			
1. Even though I terminate the transaction with the present partner and switch to a new one, I don't need to spend extra time and cost.	0.803		0.835
2. Even though I terminate the transaction with present partner and switch the new one, I can sell the products in the same way as before.	0.766	0.595 ***	
3. Even though I terminate the transaction with the present trade partner, there are no harmful effects on my business.	0.709	0.525 ***	
4. Even though I terminate the transaction with the present trade partner, it is easy to find an alternative partner.	0.703	0.581 ***	
relationship			
1. The FPC offers favorable terms of purchasing the product, because I have a good relationship with the directors.	0.844		0.829
2. The FPC offers a good price of the product, because I have a good relationship with the directors.	0.825	0.723 ***	
3. I often exchange gifts with the directors of the FPC.	0.613	0.452 ***	
4. I often hold banquets with the directors and treat them or am treated by them.	0.594	0.443 ***	
capability			
1. The PMUC knows better than I do how to sell the product well.	0.853		0.852
2. The PMUC is more knowledgeable about the characteristics of the dealt product than I am.	0.758	0.723 ***	
3. The PMUC is more knowledgeable about the technology of the dealt product than I am.	0.725	0.637 ***	
uncertainty			
1. It is easy to estimate the market trend of the dealt product.	0.758		0.778
2. It is easy to forecast whether the demand of the dealt product will expand or not.	0.740	0.578 ***	
3. It is easy to know the situation of the other rival production areas.	0.734	0.566 ***	
hold-up			
1. When the product is actually delivered to the partner, he or she will compel me to change the contracted terms in a way that is profitable to him or her.	0.911		0.741
2. I cannot but restrain positive investment for fear that the partner will compel me to cut the contracted price when the product is actually delivered to him.	0.761	0.682 ***	
3. When the product is actually delivered to the partner, he will compel me to cut the contracted price, and we need to negotiate about the price.	0.419	0.418 ***	
power			
Compared with other partners, I can easily have influence with contract terms, such as price.			
understandability			
It is easy to have the trade partner understand the merits of marketing and production of the dealt product that I grow.			

[1] Extraction method is maximum likelihood. Rotation method is Promax with Kaiser normalization.
KMO=0.807, X^2 in Test of Sphericity=6465.362(p=0.00), X^2 in Goodness-of-fit Test=468.1(p=0.00)

[2] Correlation coefficient between 1st item and each, which stands for convergent validity.
*** means significance at 1% base.

Source: Author's own work

as explanatory variables, and factor scores of each latent variable are used for analyzing. As for power and understandability, we use raw scores.

5. Regression and results

5-1 Estimation method

We examined the explanatory variables that affect *participation* using multiple regression analysis to test hypotheses, considering following points.

First, the data of explained variable, *participation*, is censored at both an upper and lower limit. The value ratio of selling through FPC is defined from 0% to 100%. 18% of the observations is ratio of 0% and 12% is ratio of 100%. These are limit observations that exclude data of stronger or weaker intension of a farmer's participation. According to Hobbs (1997), we employ tobit model to analyze the ratio of selling.

Second, an endogeneity problem occurs in our constructs. Explanatory variables are basically measurement that respondent evaluates the influence on him from FPC or the relationship with FPC. Accordingly, those measurements are independent from evaluation of respondent himself and determined outside of his decision. Those measurements are exogenous variables for a farmer's decision making about his participation. However, measurement of *capability* is not the case. Capability consists of general knowledge and specialized one. The former is evaluated by respondent regardless of evaluating himself. The latter is formed by the process that PMUC understand the merit of a farmer. Evaluation of the latter involves a subjective evaluation of his own merit. Explained variable, *participation*, is the result of decision making by himself. While respondent evaluates the PMUC's capability through evaluation of himself, he simultaneously decides whether he participates in the cooperative. Consequently, *capability* can be an endogenous variable regarding specialized knowledge.

Third, accordingly, we need to select the optimal instrumental variables. When we select the instrumental variables related to specialized knowledge, we can control the endogeneity problem of *capability*. Thus, we use *understandability* that is correlated with specialized knowledge but is not related to the ratio of selling through FPC. If the merit of the farmer can be easily understood, the specialized knowledge can be easily formed. At the same, this means the reduction of the coordination cost. The larger *understandability* and the lower coordination cost result in the larger *capability*. If we recognize the positive effect, we can confirm the existence of coordination cost and verify hypothesis 5.

5-2 Results and discussion

The regression equation that satisfied theoretical hypothesis and yielded results was as follows.

$$participation_i = \alpha + \beta_1 less\text{-}specificity_i + \beta_2 hold\text{-}up_i + \beta_3 sunkcost_i + \beta_4 capability_i + \beta_5 power_i + \beta_6 satisfaction_i + \beta_7 relationship_i + \beta_8 uncertainty_i + \beta_9 D_j + u_i \quad (4)$$

α is a constant. β_k $(k=1, 2,\cdots 9)$ is a parameter to be estimated. u_i is disturbance term. D_j is a FPC dummy. i is a number of member farmer. j is a number of FPC. According to above mentioned consideration, OLS, IV (instrumental variables regression), Tobit, IVtobit(Tobit model with continuous endogenous regressions) are employed for estimation. As for IV, we assume *capability* is an endogenous variable and employ *understandability*, *age* (age of household head), and *agriday* (agricultural working days) as instrument variables.

If each hypothesis is supported, the sign conditions of respective parameter for each explanatory variable are predicted as follows. Hypothesis 1: *less-specificity* <0. Hypothesis 2: *hold-up* is not significant. Hypothesis 3: *sunkcost* <0. Hypothesis 4: *capability* >0. Hypothesis 5: *understandability* >0. As for control variables, power >0, *satisfaction* >0, *relationship* >0, and *uncertainty* <0 are predicted. The estimated results are shown in Table 2. We omitted to show the results of each FPC dummy.

First, we verify the hypotheses using the estimated results. The sign conditions of *less-specificity*, *sunkcost*, and *capability* were significantly correspondent with our predictions in any methods. The coefficient of *hold-up* was not significant in any methods. Accordingly, the results were robust and showed that Hypothesis 1, 2, 3, and 4 were verified. In addition, the sign conditions of *understandability* were significantly correspondent with our predictions in the first step estimation of both IV and IV tobit, which showed that Hypothesis 5 was verified. Consequently, the vertical coordination design of farmer's participation driven from theoretical analysis was strongly supported.

Second, as for control variables, the sign conditions of *power* and *relationship* were significantly correspondent with our predictions in any methods. However, the coefficient of *satisfaction* was not significant if the endogeneity of *capability* is considered, although it was correspondent with our predictions in OLS and Tobit. As for *uncertainty*, the sign condition was correspondent with our predictions but not significant in any methods. *satisfaction* and *uncertainty* don't necessarily influence on the farmer's decision of participation.

Third, we calculate marginal effects of each variables in IVtobit (See Table 2). The largest is *capability*, the second is *relationship*, and the third is *less-specificity*. Considering the dis-

Table 2 Reults of Regression

	OLS		IV		Tobit		IVTobit		Marginal Effect (IVTobit)	
	Coef.		Coef.		Coef.		Coef.		Coef.	
less-specificity	-0.065	***	-0.073	***	-0.084	***	-0.096	***	-0.036	***
	(-3.77)		(-4.15)		(-3.51)		(-3.82)		(-3.88)	
hold-up	0.001		-0.013		0.005		-0.015		-0.006	
	(0.09)		(-0.75)		(0.23)		(-0.64)		(-0.64)	
sunkcost	-0.031	*	-0.036	**	-0.041	*	-0.048	***	-0.018	***
	(-1.89)		(-2.18)		(-1.8)		(-2.04)		(-2.05)	
capability	0.047	**	0.162	***	0.058	**	0.221	***	0.084	***
	(2.42)		(3.35)		(2.17)		(3.21)		(3.31)	
power	0.033	***	0.031	***	0.044	***	0.042	***	0.016	***
	(3.84)		(3.59)		(3.75)		(3.41)		(3.43)	
satisfaction	0.052	**	-0.016		0.079	***	-0.016		-0.006	
	(2.47)		(-0.47)		(2.69)		(-0.34)		(-0.34)	
relationship	0.044	**	0.075	***	0.060	**	0.104	***	0.040	***
	(2.41)		(3.41)		(2.37)		(3.34)		(3.41)	
uncertainty	-0.014		-0.025		-0.017		-0.032		-0.012	
	(-0.78)		(-1.32)		(-0.67)		(-1.20)		(-1.20)	
constant	0.195	**	0.185	**	0.076		0.061			
	(2.34)		(2.19)		(0.66)		(0.51)			
understability			0.211	***			0.212	***		
			(10.13)				(10.39)			
age			-0.005	*			-0.004			
			(-1.74)				(-1.53)			
agriday			0.000				0.000			
			(0.96)				(0.57)			
R^2	0.308		0.29							
Pseudo R^2					0.21					
Wald chi2(21)			270.50				207.25			
			(0.00)				(0.00)			
LR chi2(21)					190.62					
Durbin (score) chi2(1)			7.220							
			(0.01)							
Wu-Hausman F(1,544)			7.015							
			(0.01)							
F(3,543)			35.307							
			(0.00)							
Sargan (score) chi2(2)			3.715							
			(0.16)							
Basmann chi2(2)			3.580							
			(0.17)							
Wald exogeneity chi2(1)							6.78			
							(0.01)			

Results of estimation show absolute t value in parentheses. * significant at 10%. ** significant at 5%. ***significant at 1%. Results of test show p value in parentheses. Source: Auther's own work.

semination of marketing FPC, this paper indicates that it is important to enhance the capability of PMUC, and we recommend farmers to know the merit of utilizing the capability with incurring coordination cost. Especially, the significance of utilizing the capability increases in the case of more specificity. In addition, the traditional human relationship in a village plays important role to disseminate FPC.

Forth, we test the results of estimation used IV and IVtobit method as follows. (1) We conducted Wald test for testing null hypothesis that all coefficients are zero. Test rejected null hypothesis in both IV and IVtobit. (2) We tested endogeneity for testing null hypothesis that all variables are exogenous variables. We conducted Durbin test and Wu-Hausman test for IV and conducted Wald test for IVtobit. All test rejected null hypothesis and we verify that *capability* is an endogenous variable. (3) We conducted F test in IV for testing null hypothesis that all coefficients of instruments are zero in first step estimation. Test rejected null hypothesis and we confirm no weak instrumental variables. (4) We conducted F Sargan test and Basmann test in IV for testing null hypothesis that instruments are uncorrelated with the error term. Test failed to reject null hypothesis and we confirm that our instruments are valid.

6. Conclusion

This paper shows what factors influence the farmers' participation in a cooperative, because dissemination of FPC is strongly required for rural development in China. First, we analyze the participation model as vertical coordination design between a farmer and FPC, by using transaction cost, property right and capability approach of organizational economics. Second, we test the model by using research data of Hunan Province, and can support all hypotheses based on the model.

In conclusion, it is recommended to establish FPC based on the following obtained results. (1) The stronger relationship specificity between a farmer and FPC accelerates the farmer's participation. (2) Hold-up problem does not occur. However, if a waste of sunk cost is predicted in the case of price cut, the farmer restrains participation. (3) The larger capability of PMUC accelerates participation, but the farmer incurs coordination cost to participate. (4) The bigger bargaining power of the farmer and the stronger human relationship accelerates participation.

References

Bagozzi, R. P. ed., 1994. *Principles of Marketing Research*, Blackwell.

Cook, M. L. Barry, P., 2004. Organizational Economics in the Food, Agribusiness, and Agricultural Sectors. *American Journal of Agricultural Economics*. 86(3), 740-743.

Cook, M. L., Chaddad F. R., Iliopoulos, C., 2004. Advances in Cooperative Theory since 1990: A Review of Agricultural Economics Literature, in G. W. J. Hendriske, ed., *Restructuring Agricultural Cooperatives*, Erasmus University, Rotterdam.

Deng, H., Huan,J., Xu,Z., Roselle,S., 2010. Policy Support and Emerging Farmer Professional Cooperative in

Rural China. *China Economic Review*. 21(4), 495-507.
Frank, S. D., Henderson, D.R., 1992. Transaction Costs as Determinants of Vertical Coordination in the U.S. Food Industry. *American Journal of Agricultural Economics*. 74(4), 941-950.
Galizzi, G. Venturini, L. eds., 1999. *Vertical Relationships and Coordination in the Food System*, Springer.
Grossman, S. J., Hart, O., 1986. The Cost and Benefits of Ownership: A Theory of Vertical Lateral Integration. *Journal of Political Economy*. 94(4), 691-719.
Hart, O., 1995. *Firms, Contracts, and Financial Structure*. Clarendon Press.
Hendrikse, G. W. J., Veerman, C.P., 2001a. Marketing Co-operatives: An Incomplete Contracting Perspective. *Journal of Agricultural Economics*. 52(1), 53-64.
Hendrikse, G. W. J., Veerman, C.P., 2001b. Marketing Cooperatives and Financial Structure: a Transaction Costs Analysis. *Agricultural Economics*. 26(3), 205-216.
Hendrikse G. W. J., Bijman, J., 2002. Ownership Structure in Agrifood Chains: The Marketing Cooperative. *American Journal of Agricultural Economics*. 84(1), 104-119.
Hobbs, J. E., 1997. Measuring the Importance of Transaction Costs in Cattle Marketing. *American Journal of Agricultural Economics*. 79(4), 1083-1095.
Huang, Z., Fu, Y., Liang, Q., Song, Y., Xu, X., 2013. The Efficiency of Agricultural Marketing Cooperatives in China's Zhejiang Province. *Managerial and Decision Economics*. 34(3-5), 272–282.
Ito, J., Bao, Z., Su, Q., 2012. Distributional Effects of Agricultural Cooperatives and Buyers in China. *Food Policy*. 36(5), 656-666.
Jia, X., Huan, J., Xu, Z., 2012. Marketing of Farmer Professional Cooperatives in the Wave of Transformed Agrofood Market in China. *China Economic Review*. 23(3), 665-674.
Jia, X., Huang, J., 2011. Contractual Arrangements between Farmer Cooperatives and Buyers in China. *Food Policy*. 36(5), 656-674.
Jia, X., Hu, Y., Hendrikse, G.W.J., 2016. Centralized versus Individual: Governance of Farmer Professional Cooperatives in China, in R. Muradian, W.J.J. Bijman, and J. Schuurman, eds., *Cooperatives, Economic Democratization and Rural Development*, Edward Elgar.
John, G., Weitz B., 1998. Forward Integration into Distribution: Empirical Test of Transaction Cost Analysis. *Journal of Law, Economics, and Organization*. 4(Fall), 121-139.
Klein, S., Frazier, G., Roth, V., 1990. A Transaction Cost Analysis Model of Channel Integration in International Markets. *Journal of Marketing Research*. 27(May), 196-208.
Langlois, R. Robertson, P., 1995. *Firms, Markets and Economic Change: A Dynamic Theory of Business Institutions*, Routledge.
Majumdar, S. K. Ramaswamy, V., 1995. Going Direct to Market: The Influence of Exchange Conditions. *Strategic Management Journal*. 16(5), 353-372.
Menard, C., Klein, P.G., 2004. Organizational Issues in the Agrifood Sector: Toward a Comparative Approach. *American Journal of Agricultural Economics*. 86(3), 750-755.
Royer, J.S., Rogers, R.T., 1998. *The Industrialization of Agriculture: Vertical Coordination in the U.S. Food System*, Ashgate Publishing.
Sykuta,M.E., Cook, M.L., 2001. A New Institutional Economics Approach to Contracts and Cooperative. *American Journal of Agricultural Economics*. 83(5), 1273-1279.
Williamson,O.E., 1979. Transaction -Cost Economics: The Governance of Contractual Relations. *Journal of Law and Economics*. 22(2), 233-261.
World Bank, 2006. *China- Farmers Professional Associations: Review and Policy Recommendations*. Washington D.C., World Bank.

Note

1） Chinese government encouraged the small famers to sell their products with good price, helping by contracts with agribusiness companies or farmers organizing to keep their own profit. This encouragement is called as agricultural industrialization.

2） According to Gibbons and Roberts(2013), organizational economics has 5 approaches for analyzing. 2 of them; transaction cost and property right approach are adopted for the agricultural cooperatives analysis.

3） Williamson(1979) uses the term asset specificity that is specially related to relation specific investment. However, this paper uses the term relationship specificity that involves wider conception.

4） These results can be explained as a subgame perfect equilibrium.